ABSTRACT TITLE: A CAE Approach in Application of Nafion-Pt Composite (ICPF) Actuators
--- Analysis for Surface Wipers of NASA MUSES-CN Nanorovers ---

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PRESENTATION:
 Oral Presentation

ABSTRACT TEXT:

Nafion-Pt composite (ICPF) is one of the most practical electroactive polymer nearest to applications. CAE modeling of the actuator characteristics is an essential issue for mechanical and electrical design. Kanno-Tadokoro model is a gray-box model applicable to CAE systems. It consists of 3 stages: an electrical property, a stress generation property, and a mechanical property. In the electrical property, the input is voltage and the output is distributed current through the membrane. This model consists of distributed 3 elements: resistance of porous platinum surfaces, resistance of Nafion, and RC elements approximating experimental voltage-current response. In the stress generation stage, the input is current and the output is internal stress. The relation is expressed by an equation similar to piezoelectric materials. A current vector is transformed into a stress tensor by a matrix such as the piezoelectric coefficient matrix and by a second order delay. The mechanical property is approximated by a elastic body or a viscoelastic body. This model was applied to analysis of a surface wiper to remove dust from the visual/IR window of the Nanorover of NASA MUSES-CN mission.

As a result of simulation, the following were revealed.
- Strain near the electrode was larger than that at the tip.
- Short actuator shapes sometimes had a good performance.
- Bending in the diagonal direction spoiled the objective motion.
- Crosspieces preventing diagonal bending improved the motion.
- The performance was good at resonance frequencies.

KEY WORDS:
Electroactive Polymers, ICPF, Linear Model, MUSES-CN, Wiper Design

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1984: M.E. degree from the University of Tokyo,
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